REMARKS

Claims 1 to 22 remain pending in the application, with claims 1, 9, 17, 19, 21 and 22 being the independent claims. Reconsideration and further examination are respectfully requested.

Claims 17 to 20 were rejected under 35 U.S.C. § 112, second paragraph. In response, Applicants have amended those claims to clearly indicate that they are drawn to a computer-readable medium, which is an article of manufacture. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1 to 4, 6 to 11, 13 to 17, 19, 21 and 22 were rejected under 35 U.S.C. § 103(a) over U.S. Patent 5,619,429 (Aloni) in view of U.S. Patent 6,016,357 (Neary); claims 5 and 12 were rejected under § 103(a) over Aloni in view of Neary and U.S. Patent 5,965,306 (Mansfield); and claims 18 and 20 were rejected under § 103(a) over Aloni in view of Neary and U.S. Patent 6,171,731 (Medvedeva). Withdrawal of these rejections is respectfully requested for the following reasons.

The present invention detects defects in a reticle used in integrated circuit chip fabrication by obtaining digital image data corresponding to an image of the reticle, processing such digital image data to identify defects and then processing at least a portion of the digital image data to simulate a response that would be produced if the reticle were utilized in a photolithographic system. Such a simulation can, for example, assist a user in assessing the severity of the defect. Thus, once the digital image data for the reticle have been obtained (e.g., by scanning the reticle), both defect detection

and defect classification can be performed using the same digital image data. This approach is believed to allow faster defect detection and classification than conventional techniques would permit, thereby reducing the costs of reticle fabrication.

Thus, independent claims 1, 17 and 21 are directed to detecting defects in a reticle used in integrated circuit chip fabrication by obtaining digital image corresponding to an image of a reticle. The digital image data are processed according to predetermined criteria to identify defects and a response that would be produced if the reticle were utilized in a photolithographic system is simulated by processing the digital image data corresponding to the reticle.

Independent claims 9, 19 and 22 are directed to detecting defects in a reticle used in integrated circuit chip fabrication by obtaining digital image data corresponding to an image of a reticle, and processing the digital image data according to predetermined criteria to identify defects. A window is then specified around one of the identified defects and a response that would be produced if the specified window were to be utilized in a photolithographic system is simulated by processing digital image data corresponding to the specified window.

The foregoing combinations of features are not seen to be disclosed or suggested by the applied art. In particular, the applied art does not disclose or suggest at least the feature of processing digital image data corresponding to a reticle both to identify defects and to simulate a response that would be produced if the reticle (or a portion thereof) were to be utilized in a photolithographic system.

In this regard, Aloni discusses the conventional technique of processing digital image data corresponding to a reticle for the purpose of identifying defects. However, as noted in the Office Action, Aloni does not disclose or suggest the feature of using such digital image data to simulate a response that would be produced if the reticle were to be utilized in a photolithographic system.

In order to make up for this deficiency, the Office Action cites Neary as showing such simulation. However, Applicants have reviewed Neary in detail and are unable to find this feature of the present invention either disclosed or suggested anywhere in Neary. The specific portions of Neary cited in the Office Action are addressed as follows.

* Figure 2, defect 24 clearly shows a defect in a portion of a reticle, but by itself indicates itself nothing at all about performing a simulation as in the present invention.

* Figure 10 illustrates Neary's technique, but also is not seen to disclose or to suggest simulation by processing digital image data of a reticle. To the contrary, as described at column 6, lines 35 to 40, Neary utilizes an "aerial image measurement tool" to emulate the exposure tool upon which the mask ultimately is to be used. Column 3, lines 55 to 58, of Neary further clarifies that the "aerial image measurement tool" measures intensity of an aerial image by illuminating the reticle (or mask) with the desired light source (preferably using the Microlithography Simulation Microscope 100 AIMS).

Thus, Neary uses an optical system to emulate the aerial image produced by a mask. This is significantly different than processing digital image data corresponding to a reticle in order to simulate a response that would be produced if the reticle (or a portion thereof) were to be utilized in a photolithographic system, as recited in the present claims. It is noted that Neary does discuss utilizing a simulator to predict an ideal aerial image (column 6, lines 43 to 46); however, *first*, it is not clear whether such a "simulator" utilizes digital image data at all and, *second*, in any event, such simulation is performed only for predicting an ideal aerial image and not for an actual defective reticle, as in the present invention.

* Figure 16 of Neary illustrates an overlay of an idealized portion of a mask and the same portion of a defective mask. However, nothing in Figure 16 indicates anything at all about performing a simulation as recited in the present claims.

* As discussed above, column 6, line 25 through column 7, line 4 of Neary describes use of an optical tool to emulate an exposure tool, thereby providing an aerial image for a mask, and then comparison of this aerial image to some unspecified simulation of an ideal aerial image. Nothing in this portion of Neary says anything at all about processing digital image data for a reticle to simulate use of the reticle in a photolithographic system, as recited in the present claims.

Mansfield concerns determining the printability of photomask defects. However, Mansfield also fails to disclose or to suggest anything about simulating a photolithographic system response to a reticle based on digital image data as recited in

the present claims. The Office Action specifically cites column 7, lines 41 to 46, and column 9, lines 13 to 21, of Mansfield.

As to column 7, lines 41 to 46, that portion of Mansfield discusses analysis of the lithography process to determine the effects of mask variations. However, this step (406) of Mansfield's technique does not even concern analysis of an actual reticle, but rather involves determining a metric that is based upon the photolithographic process. See column 7, line 46 to column 8, line 10.

This observation is confirmed by referring to Figure 4, which divides Mansfield's process steps based on responsibility for such process steps (i.e., between the IC manufacturer and the mask manufacturer). There, it is seen that step 406 (analyze process window for various mask CD errors) is actually performed by the IC manufacturer well prior to manufacture of any actual masks. The theoretical analysis performed in step 406 is used to determine a metric in step 407 which, in turn, is then used to set the mask critical dimension tolerance (in step 409).

Although such mask CD tolerance ultimately will be provided to the mask manufacturer and used by Mansfield's technique in connection with mask inspection, the analysis performed back in step 406 clearly has nothing whatsoever to do with inspection of an actual reticle. To the contrary, step 412 in Figure 4 and the corresponding description at column 8, line 59 to column 9, line 4 indicate that in Mansfield's technique the inspection of actual masks is performed by using an optical system for aerial image emulation.

Finally, column 9, lines 13 to 21 of Mansfield discusses defect classification. However, that portion of Mansfield says nothing at all about any type of photolithographic system response simulation, much less the specific technique for such simulation that is recited in the present claims. As a result, nothing in Mansfield would have disclosed or suggested this feature of the present invention.

Medvedeva concerns aerial image simulation, but does not disclose or suggest utilizing such simulation in connection with reticle inspection as in the present invention, and the Office Action has not even alleged that it does.

As a result, it is apparent that no permissible combination of the applied art would have disclosed or suggested processing digital image data corresponding to a reticle both to identify defects and to simulate a response that would be produced if the reticle (or a portion thereof) were to be utilized in a photolithographic system. Independent claims 1, 9, 17, 19, 21 and 22 are therefore believed to be allowable over the applied art.

The other claims in the application depend from these independent claims and are therefore believed to be allowable for at least the same reasons. In addition, each such dependent claims recites an additional feature of the invention that further distinguishes the invention from the applied art. Accordingly, the individual reconsideration of each on its own merits is respectfully requested.

In view of the foregoing remarks, the entire application is believed to be in condition for allowance, and an indication to that effect is respectfully requested.

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Respectfully submitted,

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APPENDIX A

Version with Markings to Show Changes Made

17. (Amended) [An apparatus comprising a] A computer-readable medium having encoded thereon computer-executable process steps, said process steps for detecting defects in a reticle used in integrated circuit chip fabrication, wherein said process steps comprise steps to:

(a) obtain digital image data corresponding to an image of a reticle;

(b) process the digital image data according to predetermined criteria to identify defects; and

(c) simulate a response that would be produced if the reticle were to be utilized in a photolithographic system, by processing the digital image data corresponding to the reticle.

18. (Amended) [An apparatus] A computer-readable medium according to Claim 17, wherein said computer readable medium comprises at least one of a magnetic diskette, magnetic tape, a CD-ROM, a random access memory chip, and a read-only computer memory chip.

19. (Amended) [An apparatus comprising a] A computer-readable medium having encoded thereon computer-executable process steps, said process steps for

detecting defects in a reticle used in integrated circuit chip fabrication, said process steps comprising steps to:

(a) obtain digital image data corresponding to an image of a reticle;

(b) process the digital image data according to predetermined criteria to identify defects;

(c) specify a window around one of the defects identified in step (b); and

(d) simulate a response that would be produced if the window specified in step (c) were to be utilized in a photolithographic system, by processing digital image data corresponding to the window specified in step (c).

20. (Amended) [An apparatus] A computer-readable medium according to Claim 19, wherein said computer readable medium comprises at least one of a magnetic diskette, magnetic tape, a CD-ROM, a random access memory chip, and a read-only computer memory chip.